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(71) Applicant *(for all designated States except US)*: LIFERAFT SYSTEMS AUSTRALIA PTY. LIMITED [AU/AU]; 5 Sunmont Street, Derwent Park, TAS 7009 (AU).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: LOGAN, Iain [GB/GB]; 3 Aville Cottages, Dunster Near Minehead, Summerset TA24 5TB (GB).

(74) Agent: A. TATLOCK & ASSOCIATES; 21 Queensberry Street, Carlton, VIC 3053 (AU).

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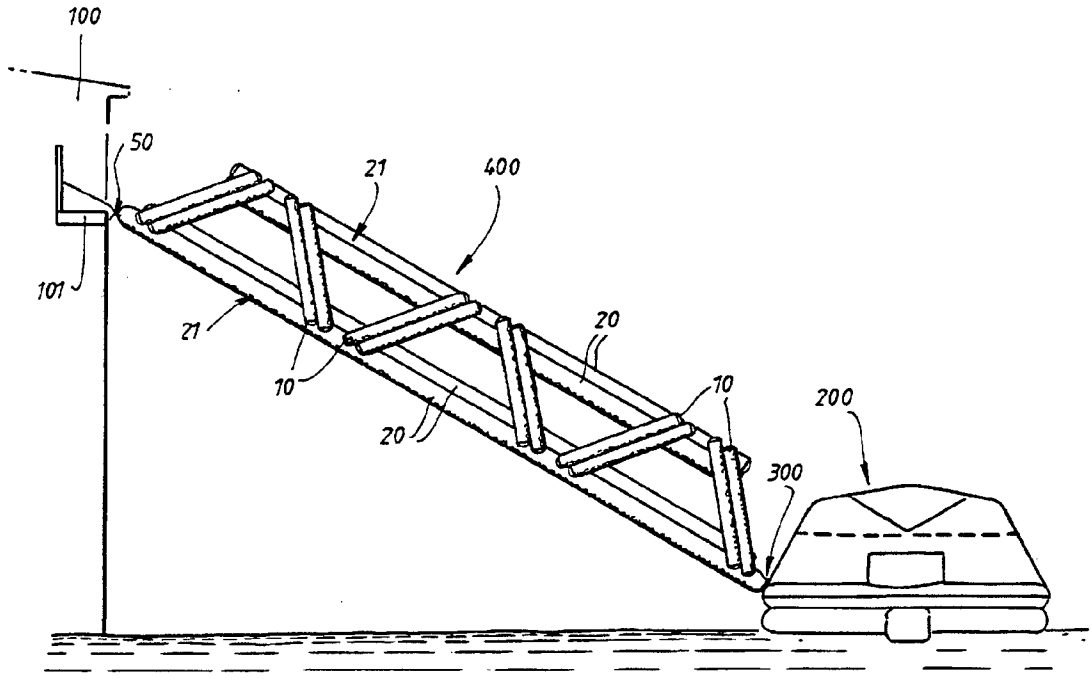
(54) Title: MARINE EVACUATION SYSTEM



(57) Abstract

A marine evacuation system comprising an inflatable evacuation slide connected to an inflatable liferaft (200) by releasable slide/liferaft interface coupling units. The interface coupling units are flexible to provide for relative movement of the slide and liferaft (200). The entire evacuation system can be easily released and inflated within a short time frame and provides a liferaft (200) capable of holding of the order of 100 passengers.

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MARINE EVACUATION SYSTEM

This invention relates to an inflatable escape slide suitable for use with a high capacity inflatable liferaft capable of holding of the order of 100 people. The slide combines strength and evacuee security while enabling the system to be operational within a time frame of the order of two minutes.

For many years the use of conventional lifeboats on board ships presented problems with respect to on board storage, release and passenger loading. The latter two functions being effected only with the deployment of considerable manpower.

The more recent development of inflatable liferafts has lead to decreased storage problems however problems of quickly and safely loading passengers remain unaddressed particularly as previous life rafts have not had a particularly high occupant carrying capacity. The desirability of quick, safe evacuation procedures has unfortunately been demonstrated by the high loss of life associated with the sinking of ferries and other craft in recent years.

It is the object of this invention to provide in a marine evacuation system an inflatable evacuation slide with an associated inflatable life raft, which marine evacuation system can be easily released and inflated by a single person within a time frame of the order of two minutes and which provides for the safe evacuation of up to 100 or so passengers, within a time

frame of the order of five minutes, into a single high carrying capacity liferaft.

The invention, in its broadest sense, is a marine evacuation system comprising an evacuation slide connected to an inflatable liferaft by releasable slide/liferaft interface coupling units.

In order that the invention may be more readily understood we shall describe a particular embodiment of this invention in relation to the accompanying drawings in which:

Fig. 1 shows a schematic view of the slide extending from the storage cradle on a ship to the liferaft in the water.

Fig. 2 is a plan view from above of the slide extending between the storage cradle and the liferaft.

Fig. 3 shows a schematic view of the slide then liferaft inflation process.

Fig. 4 shows a plan view from above showing the triangular cross bracing of the slide in the absence of the longitudinal tubes at the apex of the slide.

Fig. 5 shows a side elevation of the evacuation slide

Fig. 6 shows a cross-section of the evacuation slide.

Fig.7 is a plan view of the slide interface coupling.

Fig. 8 shows a vertical cross-section A - A through the slide interface coupling, shown in Fig. 7, parallel to two of the rings.

Fig. 9 is a section B - B, shown in Fig. 7, showing a saddle with ferrule.

Fig. 10 is a plan view of the raft interface coupling.

Fig. 11 shows a vertical cross-section along section A - A shown in Fig. 10.

Fig. 1 shows a schematic diagram of the marine evacuation system with the evacuation slide 400 extending from the slide/liferaft stowage cradle 101 on the ship 100 to the liferaft 200.

Fig. 2 shows a plan view from above of the features of Fig. 1 with the evacuating passengers 40 descending to the liferaft 100 which is attached to the slide 400 at the slide/liferaft interface coupling 300.

In this preferred form of the invention the slide 400 is constructed from nine longitudinal tubes 20, each separately inflated, bonded together in three groups of three which form

(Fig. 6) the apex, left hand corner and right hand corner of an isosceles triangle when viewed in cross-section. These longitudinal tube stacks 21 are held apart by a series of paired diagonal bracing tubes 10 which are inflated from alternate longitudinal tubes 20 and tube stacks 21.

The exact number of longitudinal tubes used is not material to this invention neither is the number of diagonal bracing tubes except in as much as the requirement for adequate strength of the slide is met.

The slide also need not necessarily be triangular in cross-section however the preferred form of an isosceles triangle provides the simplest structurally sound mode of construction. The length of the slide used will also vary depending on the drop height required.

In this embodiment of the invention all the individual inflatable tubes of the slide are manufactured from a polyurethane coated nylon fabric using high frequency welding techniques. Cold stick adhesive bonding procedures are used to join the longitudinal tubes 20 into stacks 21 and to join the bracing tubes 10 to the stacks. The material used to manufacture the tubes 10, 20 is not pertinent to this invention neither are the bonding and fabrication techniques used however all materials and methods of manufacture must comply with the relevant legislative requirements.

The base of the preferred form of the slide is a full length netting slide path 23 which allows for drainage of water and contributes to the control of passenger descent speed. The descent speed can be further decreased prior to entry into the liferaft by the use of appropriate contouring.

The slide 400 is attached to a slide/liferaft stowage cradle 101 by two high strength webbings 50 on each side of the slide on its underside. These webbings are connected at the other end of the slide to the interface coupling unit 301 (Fig. 7) on the slide which when coupled with the liferaft interface unit 302 to form the slide/liferaft interface unit 300 acts to absorb all tensile loadings placed on the slide.

When not in use the slide is wrapped around the liferaft container 250 and stored in a slide/liferaft stowage cradle 101 which is a welded marine grade aluminium structure which is bolted to bed plates welded to the vessel's deck. The slide/liferaft unit is restrained therein by webbing straps which are released by a hydrostatic release unit or by a vacuum remote release unit which is easily operated by a person from the inboard side of a vessel.

Slide inflation (Fig. 3) is achieved by a carbon dioxide/nitrogen gas mix stored in four cylinders, plus two top up cylinders, stored within the slide/liferaft cradle unit 101, the exact number of cylinders not being relevant to this invention. The gas

is fed via manifolds to the nine longitudinal slide tubes 20 each of which is fitted with a high flow relief valve. The liferaft end of the slide is fitted with a pair of webbing loop patches to which the liferaft inflation lanyards 401 can be attached causing the liferaft to commence to inflate during the latter part of the slide inflation.

In the preferred form of the invention the liferaft 200 used in association with the slide has the capacity to hold 100 passengers. It has two superimposed buoyancy chambers each divided along the centreline to give left and right hand chambers. Four integral arch and thwart tubes are inflated via feed tubes and transfer valves from these four buoyancy chambers, the arch tubes providing automatic erection and support for the canopy and the thwart tubes giving structure to the base of the liferaft sufficient to permit the construction of high carrying capacity liferafts. The slide which is the subject of this invention can then be used to load of the order of 100 passengers into an appropriate life raft in a time span of the order of 5 minutes.

In this preferred form of liferaft a carbon dioxide/nitrogen gas mixture is stored in four high pressure aluminium cylinders and inflation is initiated by the pulling of the liferaft inflation lanyards 401 attached to the slide 400 which operates two of the four gas cylinders, the remaining two gas cylinders being operated by lanyards activated as the liferaft commences

inflation. The gas is fed from each cylinder by a cable actuated valve with a bifurcated swivel outlet to each buoyancy chamber via two hoses and two inlet check valves. The inlet check valves feed the gas into a buoyancy liner to prevent direct impingement of inflation gas jets on the buoyancy fabric. Excess gas is vented from each buoyancy chamber by a high flow relief valve and each buoyancy chamber, arch and thwart tube is fitted with a top up valve for the purpose of manual inflation.

A portion of each floor section of the liferaft is double skinned to provide an insulated seating area when manually inflated and the materials used, and the methods of construction, are the same as those for the slide.

The periphery of the underside of the floor has a series of water pockets attached which have a cross-section in the form of an isosceles triangle with the base of the triangle attached to the liferaft's underside. The apex of the triangle is ballasted to ensure rapid filling of the water pockets via a series of apertures cut close to the upper edge of the pocket.

The liferaft is constructed to comply with the requirements of The Commonwealth of Australia Marine Orders Part 25 (Equipment - Life Saving) and is accordingly equipped. The double skinned canopy provides entrances at each end of the liferaft and an enlarged entrance on each side. In the preferred form of the

liferaft the slide is attached to the liferaft at one of these side entrances by the use of the two interface couplings.

The slide/liferaft interface units 300 consist of stainless steel fittings attached one to the liferaft 302 the other to the slide 301. The slide interface coupling units 301 (Fig. 7) are connected to the webbing straps 50 on either side of the slide 400 and consist of a base plate 310 with 4 rings 311 mounted orthogonally thereon (Fig 8) about a central attachment point 330 and having a saddle 313 (Fig. 9) external to the central area containing the rings.

The liferaft interface coupling unit 302 consists also of a base plate 350 with 4 orthogonally oriented rings 311 (Fig. 10) mounted on it such that when the liferaft 302 and slide 301 coupling units are interfaced the rings of one unit are oriented at 45 degrees to those of the other unit. The arrangement is such that, when coupled, all the rings are contained within a stainless steel tube 260 mounted on the baseplate 350 of the liferaft interface coupling unit.

The fittings on the slide and liferaft are coupled together by the passage of a cord from attachment point 330 through the rings 311 and out through a saddle 313 with a ferrule mounted on the baseplate of the slide interface coupling unit. This cord is then attached to the slide and is able to be released either hydrostatically or manually.

The connections between the slide, vessel interface and liferaft are flexible to allow for ship and sea movement. The connections between the slide and liferaft are external to the GRP liferaft container 250 to allow for hydrostatic release of the liferaft.

The precise number of rings on each of the slide and liferaft interface units is not germane to this invention however the number used in this embodiment is considered optimum to provide the flexible coupling which is necessary as the slide and liferaft move relatively to each other.

This invention provides a structurally sound slide to a liferaft which slide safely encloses the evacuating passengers. The speed with which it can be inflated, and the fact that this inflation can be carried out by a single person, makes possible the use of a single high passenger capacity liferaft in conjunction with the slide to quickly evacuate passengers when necessary.

While we have described here one specific embodiment of the invention it is to be understood that variations and modifications in this can be made without departing from the spirit and scope of the invention.

We claim:

1. A marine evacuation system comprising an evacuation slide connected to an inflatable liferaft by releasable slide/liferaft interface coupling units.

2. A system as claimed in claim 1 in which the slide/liferaft interface coupling units are releasable hydrostatically.

3. A system as claimed in claims 1 and 2 in which the evacuation slide is inflatable.

4. A system as claimed in claim 3 in which the inflatable evacuation slide is constructed of groups of longitudinal members which may be tubes.

5. A system as claimed in claim 4 in which the groups of longitudinal tubes in cross-section form a triangle.

6. A system as claimed in claim 5 in which the groups of longitudinal tubes are held apart by diagonal bracing tubes.

7. A system as claimed in any of claims 4, 5 and 6 in which the number of longitudinal tubes in a group is three.

8. A system as claimed in any preceding claim in which the evacuation slide has a full length slide path fitted to its base.

9. A system as claimed in claim 8 in which one end of the evacuation slide is attached to a stowage cradle.

10. A system as claimed in claim 9 in which the attachment is by at least one strong flexible member on each side of the slide.

11. A system as claimed in claims 9 and 10 in which the flexible member is webbing.

12. A system as claimed in claims 9, 10 and 11 in which the flexible members run the length of the slide, from the stowage cradle to the liferaft end of the slide, where they are attached to slide interface coupling units adapted to interface with complementary fittings on the liferaft being liferaft interface couplings .

13. A system as claimed in claim 12 in which the slide interface coupling unit comprises a base plate with at least one ring device mounted thereon.

14. A system as claimed in claim 13 in which the liferaft interface coupling unit comprises a baseplate with at least one ring device mounted thereon.

15. A system as claimed in claim 13 and claim 14 in which the base plate of either the slide interface coupling unit or the liferaft interface coupling unit can have mounted thereon either or both of an attachment point for a cord device and a saddle device through which such cord device can be lead.

16. A system as claimed in claims 13, 14 and 15 in which the base plate of either the slide interface coupling unit or the liferaft interface coupling unit has mounted thereon a tubular member such that when the units are coupled together the rings of each unit are contained therein.

17. A system as claimed in claim 16 in which the tubular member has at least one recess in its upper surface.

18. A system as claimed in claim 16 or claim 17 in which the slide interface coupling unit and the liferaft interface coupling are held in position relative to each other by the passage of a cord member through their rings.

19. A liferaft for use in a marine evacuation system which can be flexibly coupled to an evacuation slide.

20. A liferaft as claimed in claim 19 in which the liferaft is fitted with at least one interface unit, adapted for coupling to an evacuation slide fitted with complementary interface units, which comprises a base plate with at least one ring device mounted thereon.

21. An evacuation slide for use in a marine evacuation system which can be flexibly coupled to a liferaft.

22. An evacuation slide as claimed in claim 21 in which the slide is fitted with at least one interface unit, adapted for coupling to a liferaft fitted with complementary interface units, which comprises a base plate with at least one ring device mounted thereon.

23. A liferaft as claimed in claim 20 with a carrying capacity of at least 100 passengers.

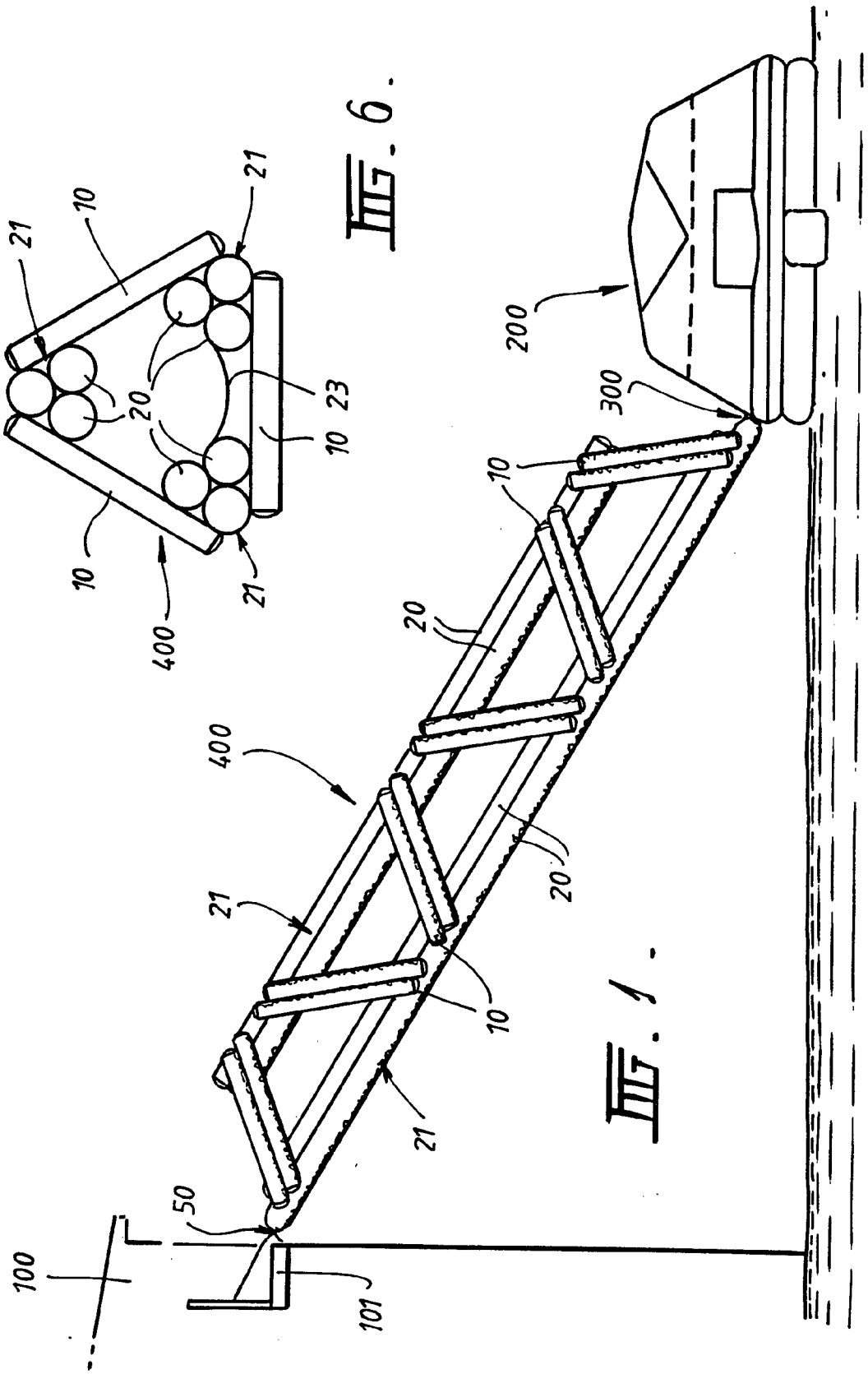


Fig. 6.

Fig. 1.

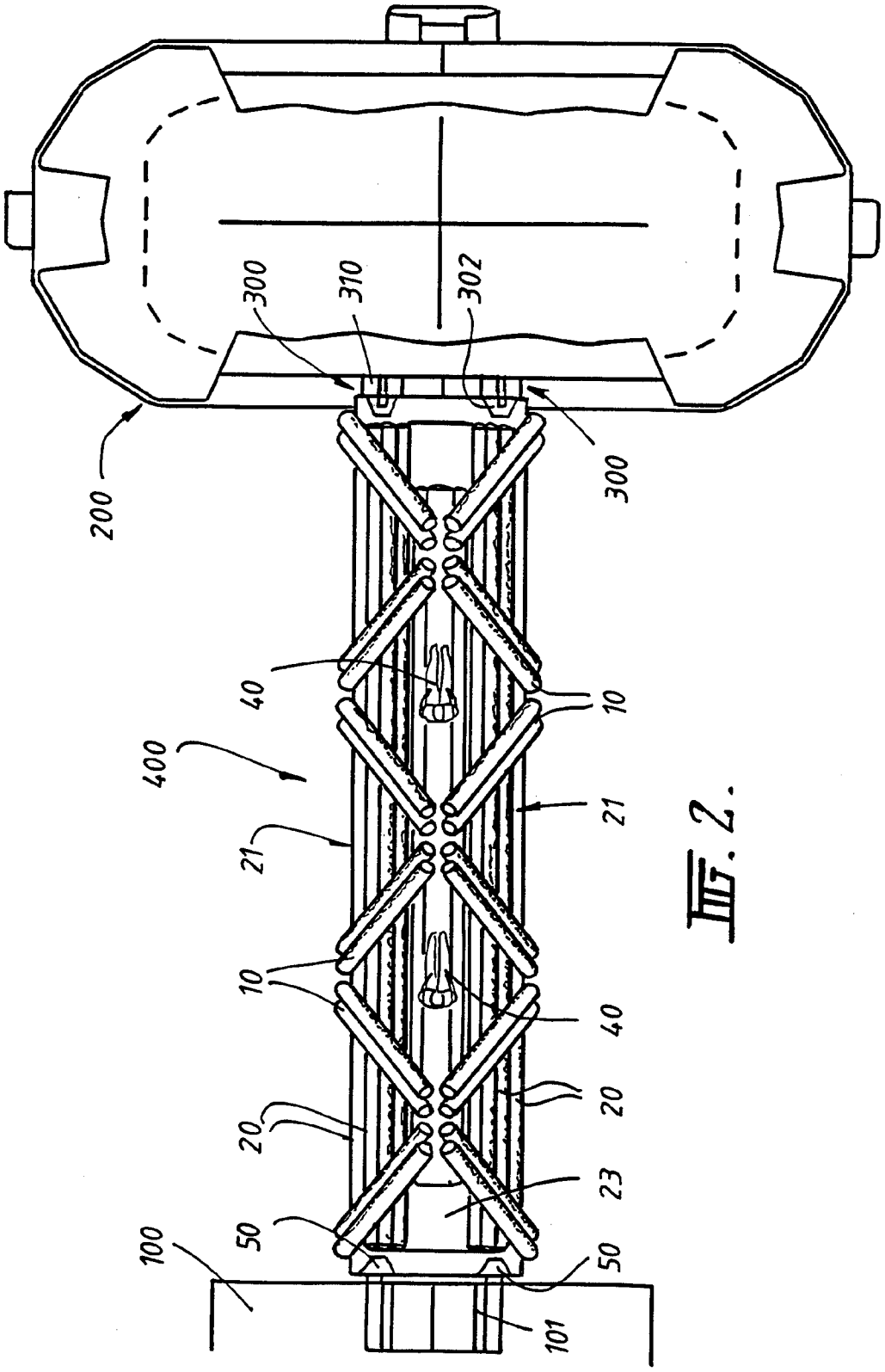
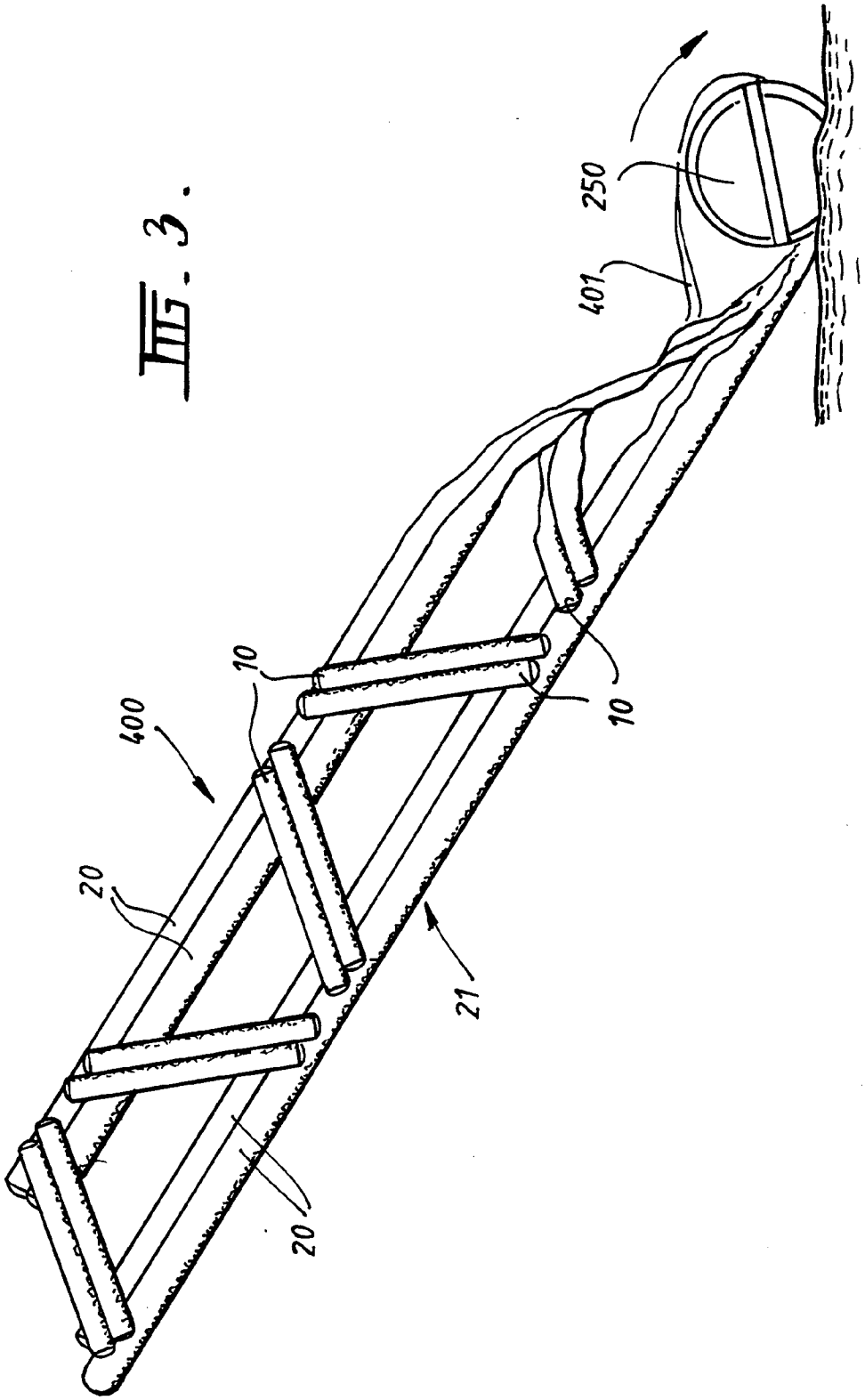


FIG. 2.

FIG. 3.



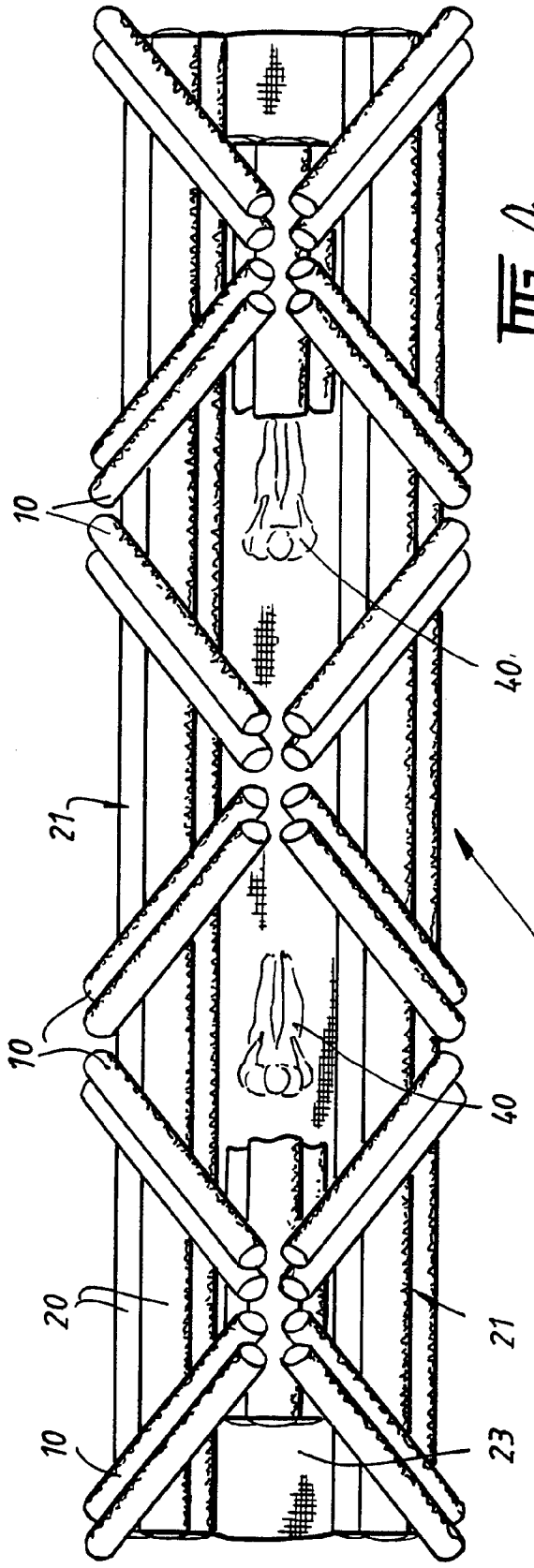


FIG. 4.

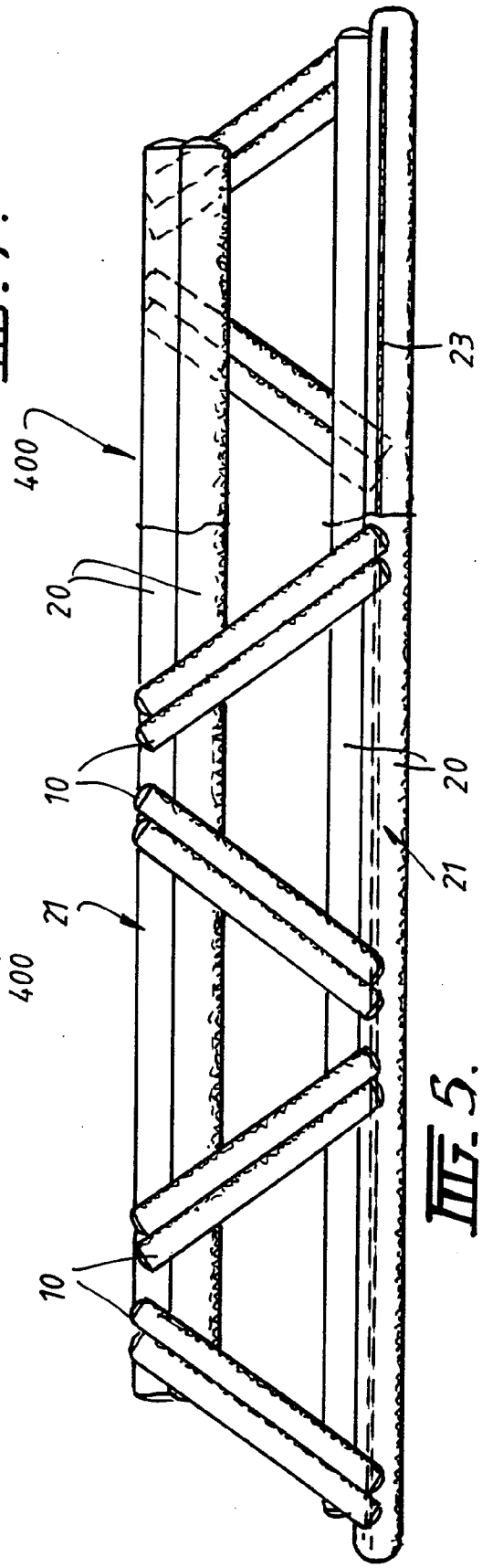


FIG. 5.

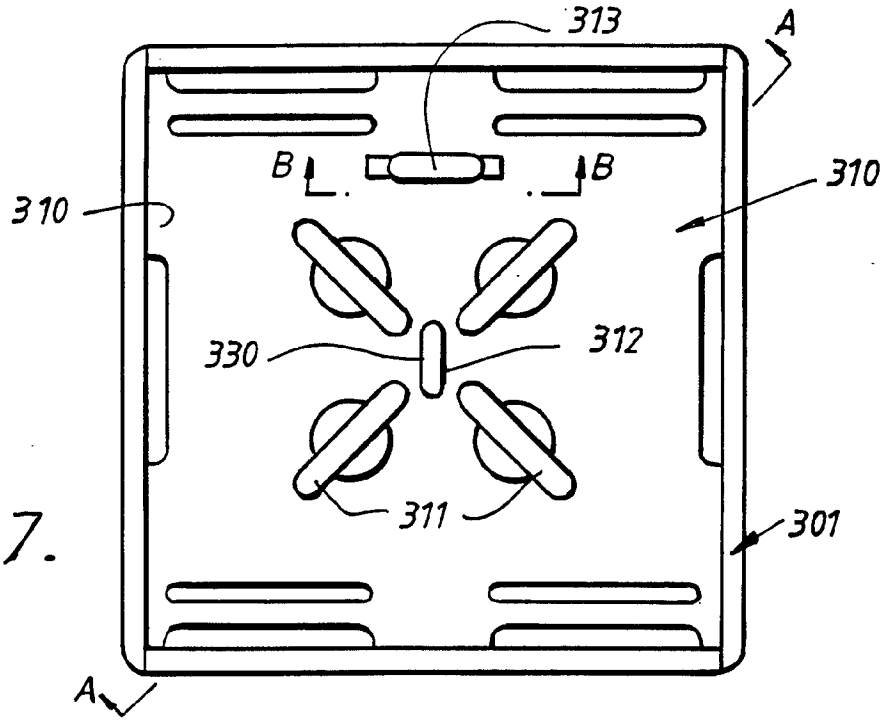


FIG. 7.

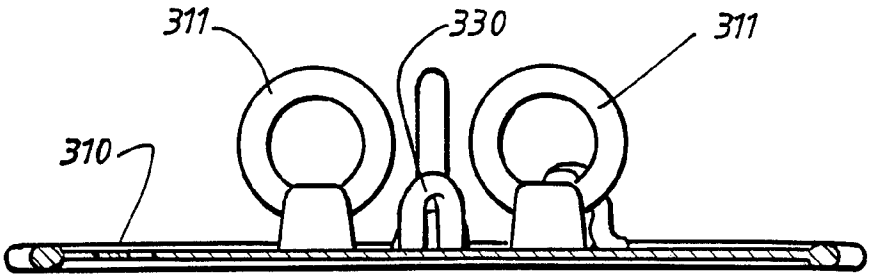


FIG. 8.

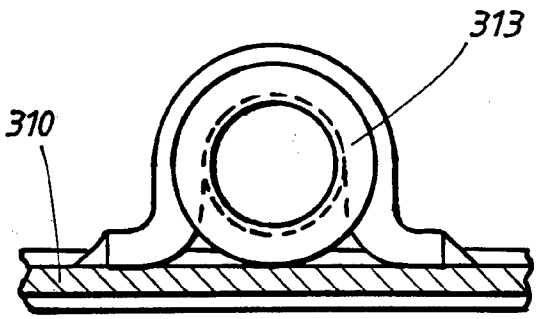


FIG. 9.

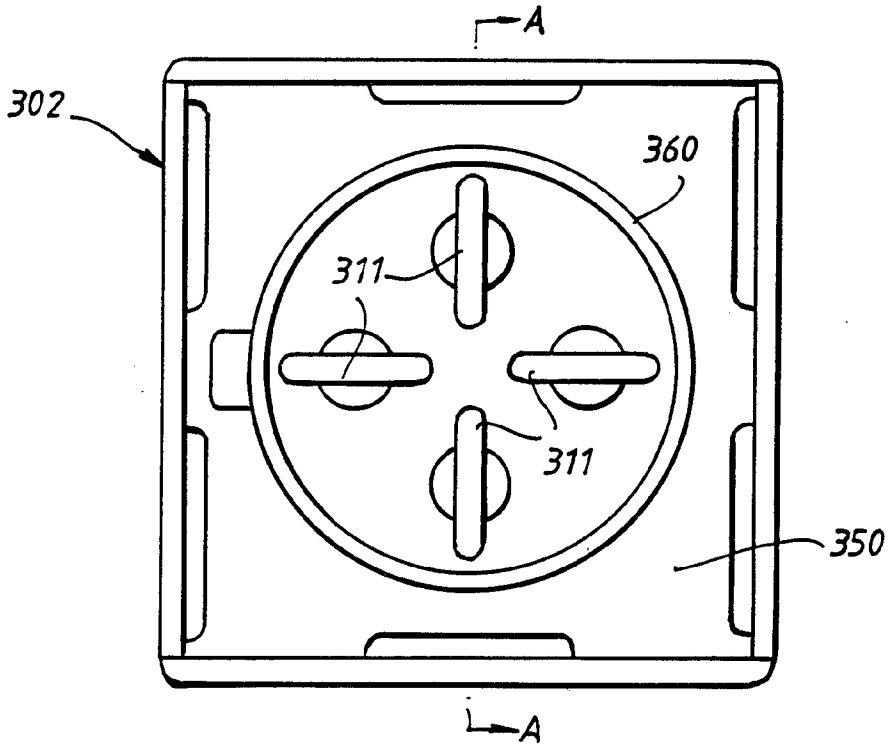


FIG. 10.

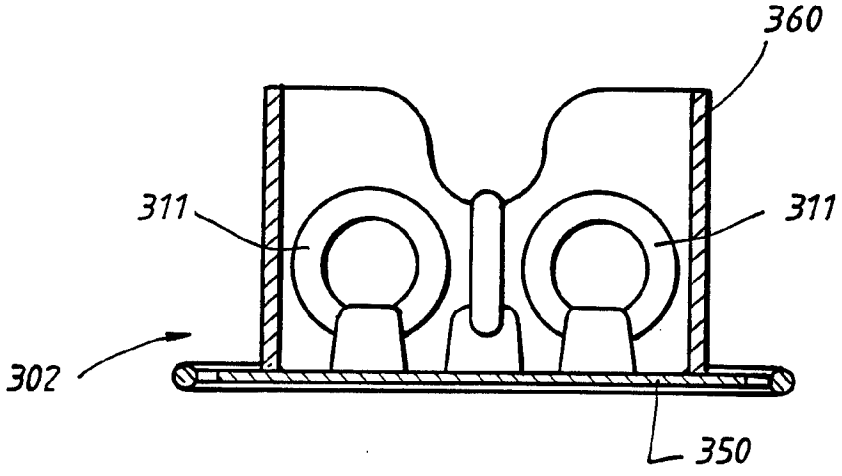


FIG. 11.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00717

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[6] B63C 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B63C 9/00, 9.02, 9/04, 23/00, 23/28, B64D 25/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X,Y	AU,A, 25814/57 (214404) (LEA BRIDGE INDUSTRIES, ESSEX, LIMITED) 29 August 1957 (29.08.57) whole document	1-11, 19-23
Y	US,A, 4519782 (FISHER) 28 May 1985 (28.05.85) Fig. 5	5-7
Y	GB,A, 1172802 (B.F. GOODRICH COMPANY) 3 December 1969 (03.12.69) page 3, lines 90-108	10-11

[X] Further documents are listed in the continuation of Box C.

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WODEN ACT 2606
AUSTRALIA

Facsimile No. 06 2853929

Authorized officer

C. M. WYATT

Telephone No. (06) 2832538

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	**Citation of document, with indication, where appropriate of the relevant passages**	**Relevant to Claim No.**
X	Derwent Abstract Accession No. 91-020012/03, class Q 24, SU,A, 898704 (MURMANSK NAVAL ENG) 15 June 1990 (15.06.90) abstract	1-4, 8-9, 19-23
X,Y	GB,A, 2131369 (RDF LIMITED, UK) 20 June 1984 (20.06.84) page 3, lines 29-32 and Figs. 1, 2, 4 and 5	1-11, 19-23
X,Y	GB,A, 2105264 (RFD INFLATABLES LIMITED, GREAT BRITAIN) 23 March 1983 (23.03.83) page 3, lines 44-46, 100-103 and Fig. 8	1-11, 19-23
X,Y	GB,A, 869067 (RFD COMPANY LTD et al) 25 May 1961 (25.05.61) page 1, lines 68-74; page 2, lines 119-129 and Figs. 1-6	1-11, 19-23
X,Y	GB,A, 2168008 (FUJIKURA RUBBER LTD, JAPAN) 11 June 1986 (11.06.86) page 9, lines 35-59; page 10, lines 8-24 and Figs. 31-33	1-11, 19-23
X,Y	GB,A, 854627 (LATIMER-NEEDHAM) 23 November 1960 (23.11.60) page 1, lines 67-73 and Figs. 1-3	1-11, 19-23

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Patent Document Cited in Search Report	Patent Family Member					
US 4519782	CA	1138795	EP	34358	JP	56135398
GB 1172802	DE	1556427	FR	1554416	NL	6802304
GB 2131369	CA	1202830	DK	5615/83		
GB 2105264	CA	1191743	DK	2247/82	FR	2505767
	IT	1147977	JP	57194186	AU	49258/85
	CA	1263092				
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